ADP2000 instructions

Digital-type differential pressure sensor

- Excellent repeatability, with no drift
- Built-in temperature compensation
- High reliability and long-term stability
- High SNR
- Built-in MCU with high processing power
- Short response time and fast measurement speed
- Small size, small weight

Product brief

The ADP2000 sensor is a digital differential pressure sensor, and an internal thermal sensor element measures the pressure difference of the gas. The sensor can achieve no drift and very high precision Measure the pressure difference between air, nitrogen, and oxygen.It also has excellent accuracy in the low pressure difference. It has excellent performance in terms of sensitivity, impact resistance and temperature changes.

The ADP2000 sensor has a standard I2C interface, simple communication mode, can be easily connected to the microprocessor.

Applied range

Designed for high-precision differential pressure measurement, the ADP2000 responds to up to 10ms quickly and responds quickly to air, nitrogen, and oxygen. HVAC applications with harsh environment and low cost, such as VAV controller, burner, heat recovery system and filter monitoring); but also can be customized for customer needs, such as: fire residual pressure monitoring system in intelligent fire protection, pipe blockage monitoring and volume control in warm air conditioning, fresh air system, building automation, gas flow precise control and monitoring in the medical field.

Figure 1.ADP2000 Differential pressure sensor

1. Sensor parameters and materials

1.1 Sensor parameters

Table 1. Sensor parameters

Parameter	Description
Measuring range	-125～125Pa
Zero point accuracy	0.3Pa
Accuracy	Readings were 3%
Zero point repetition	0.1Pa
Repetitiveness	Reading is 0.5%
Annual offset	< 0.05Pa
Response time	10ms
Calibrate the gas	air
Fluid compatibility	Air, nitrogen, oxygen (non-condensation state)
Temperature compensation range	0～50°C
Sheathing material	LCP

Note: Unless otherwise stated, all sensor differential pressure parameters are measured at 25°C, VDD = 3.3 V, and absolute pressure = 966 mbar.

1.2 Temperature parameters

Table 2. Temperature parameters

Parameter	Numeric value
Measuring range	-40～85°C
Accuracy	At-10 to 60 °C, and at 2°C at-40 to 85 °C, 3°C
Repetitivenes s	0.3°C

Note: The temperature indicated in the table is the temperature in the sensor. This temperature value depends not only on the gas temperature, but also on the ambient temperature around the sensor.

1.3 Electrical parameters

Table 3. Electrical parameters

Parameter	Symbol	State	Least value	Representative	Crest	Unit
Power	VDD	-	3.2	3.3	3.4	V
Source current	IDD	Measure	-	3.8	5.5	mA
		Idle condition	-	-	1.1	mA

1.4 Timing

Table 4. Time parameters

Parameter	Description
Power-up time (sensor accuracy Ready for the time of time)	≤25ms
I^2CSCL frequency	≤100kHz
Differential pressure value update rate (continuous Under mode)	100Hz

1.5 Mechanical parameters

Table 5. Mechanical parameters

Parameter	Numeric value
Allow overpressure	1bar
Rated blasting pressure	5bar
Weight	0.4g

Parameter	Range
Voltage	-0.3～3.4V
Maximum voltage on the pin (SDA, SCL)	-0.3～V_{DD}+0.3V
Input current on any pin	±70 mA
Operating and storage temperature range	-40～85°C
Storage temperature range	-40～85°C
ESD HBM (Mannequin)	2kV

Note: This parameter is specific for the air and nitrogen gas. Chronic exposure to oxygen at high temperatures (> 50℃) shortens product life. V in the table$_{DD}$Referring to the power supply voltage V in Table 3$_{DD}$。

2. Pin assignment

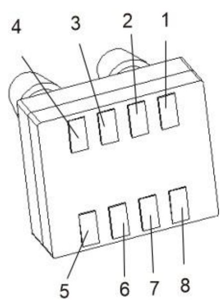


Figure 2.ADP2000 Digital pin assignment

Table 8. ADP2000 Digital pin

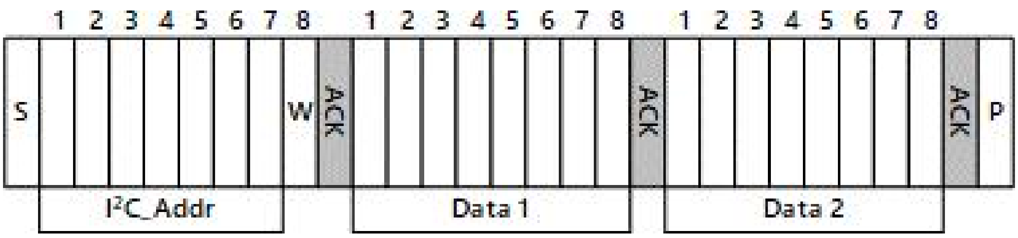
Pin	Name	Description
1	VDD	VDD source
2	SDA	serial data (I2C joggle)
3	GND	landing
4	SCL	serial clock (I2C joggle)
5~8	N/C	Empty pin

3. IC and CRC check

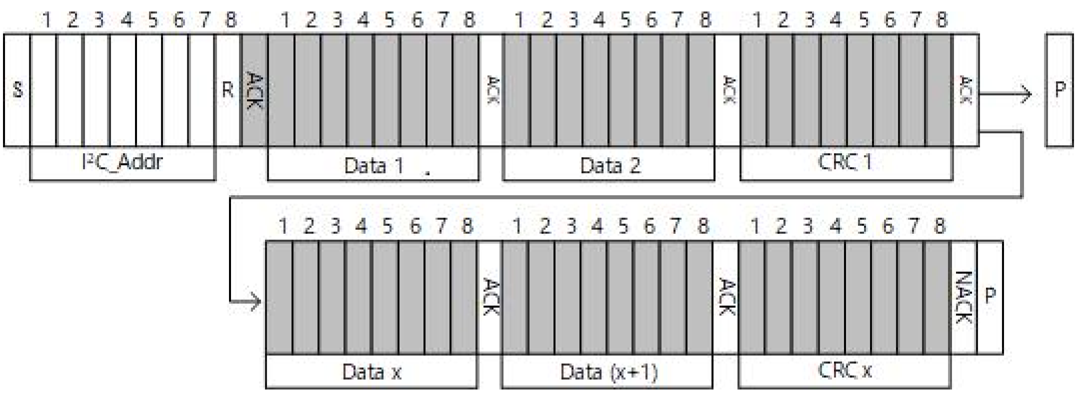
The ADP2000's version, the IThe C address is 0x25, or 0100101, with a total of 7 bits. This address is followed by a read or write bit, IThe C address is 0x4a and the read is 0x4b.The CRC (cyclic redundancy check) is an algorithm that performs polynomials on the data and attaches the resulting results back to the frame. The receiving device also performs a similar algorithm when receiving the data, which is mainly used to detect or verify the possible errors after the data transmission or storage, to ensure the correctness and integrity of the data transmission.

3. 1 IC sequence

IThe timing of the C host (computer) when writing data and receiving instructions and data is shown in FIGS. 2 and 3, and the instructions in the figure are both 16bit. Sensor data is output at 16bit, followed by an 8bit checksum per word, to ensure communication reliability.



graph 2.I2C The host performs with a written 16-bit data command timing diagram



S: Start bit (Start); W / R: write / read bit; ACK: reply bit; NACK: non-answer bit; P: Stop bit (Stop); Data x: data command; CRC x: check command; white bottom data bit: host signal; gray bottom data bit: slave signal

graph 3.I2The C host performs a reading instruction and receives a plurality of 16-bit data instructions and a CRC check code timing diagram

3.2 I2C Read instructions

The sensor can measure differential pressure and temperature simultaneously and can pass through hexadecimal IC Read the instruction, the continuous measurement instruction (0x361E) and a single measurement instruction (0x372D) read the above two measurements, when the continuous measurement, the measurement result update time is 10ms.
After sending the continuous measurement instructions, the chip will continuously measure and update the measurement results. New results can be read continuously using only continuous measurement instructions. In addition, product identification and communication testing can also be conducted through the product type reading instructions (0xE201). See Table 9.

Table 9. I2C Read the instruction and its description

instruct	Byte descripti on	rem arks
continuous measureme nt （0x361E ）	Bytes 1: differential pressure raw data high 8 bit bytes 2: differential pressure raw data low 8 bit bytes 3: CRC Byte 4: Temperature data high 8 bits Bytes 5: Temperature data low 8 bits Byte 6: CRC	After starting the continuous measurement, the measurement results are read out; the temperature and scale factors do not require each readout; the read action is terminated by the NACK and STOP conditions.
Product type read （0xE201）	Byte 1: Data High 8 bit (41) Byte 2: Data Low 8 bit (53) Byte 3: CRC (D1)	The product type is uniquely identified, and the same type of sensor can read the same product type reading instructions. The ADP2000 has a product type code of 0x4153.

3.3 Checksum calculation

CRC generally has three criteria: CRC8, CRC16, and CRC32, and CRC8 is used in ADP2000. With a polynomial, x_8+ x_5+x_4+ 1 (0x31) As an example, the CRC8 checksum bytes are generated by the CRC algorithm with the attributes shown in Table 10.

Table 10. Values corresponding to each attribute

attribute	price
length	8bit
multinomial	x_8+ x_5+ x_4+1
initial value	0xFF
Whether the input needs to reverse	False
Does the output need to be reversed	False
Finally different or numerical	0x00

The C language code for calculating the CRC code is as follows:

```
    //*************************************************************
/ / Function name: Calc_CRC8
/ / Function: CRC8 calculation, initial value: 0xFF, polynomial: 0x31 (x8 + x5 + x4
+ 1)
/ / Parameter: u8 * data: the first number of CRC validity test; u8 Num: CRC
validity test data length
/ / Return: crc: The calculated value of crc8
//*************************************************************
u8 Calc_CRC8(u8 *data, u8 Num)
{
    u8 bit,byte,crc=0xFF;
    for(byte=0; byte<Num; byte++)
    {
        crc^=(data[byte]);
        for(bit=8;bit>0;--bit)
        {
            if(crc&0x80) crc=(crc<<1)^0x31;
            else crc=(crc<<1);
        }
    }
    return crc;
}
```

4. The signal is converted to the physical values

The conversion of differential pressure and temperature signals into physical values is done by scaling factors.

4.1 coeffcient scale

Table 11. Scale factor

parameter	description
Pressure difference ratio factor	240 Pa^{-1}
Pressure difference ratio factor	59’780（inch H_2O）$^{-1}$
Temperature ratio factor	200 $°C^{-1}$

4.2 differential pressure

The digital calibration differential pressure signal read from the sensor is a signed integer (binary complement). Integer values can be converted to physical values by dividing them by a scaling factor.

Pressure difference = Sensor output integer value pressure difference ratio factor

For example, when the number read from the sensor is 0x5DC0, the 0x5DC0 is converted into a decimal integer of 24000, and the pressure difference =24000240 =100Pa。

4.3 temperature

The digital calibration temperature signal read from the sensor is a signed integer (binary complement). Integer values can be converted to physical values by dividing them by a scaling factor.

Temperature (℃) = The sensor output integer value temperature scale factor

For example, the number read from the sensor is 0x0FA0,0x0FA0 is converted into a decimal integer of 4000, and the temperature is =4000200=20℃.

5. Overall dimensions

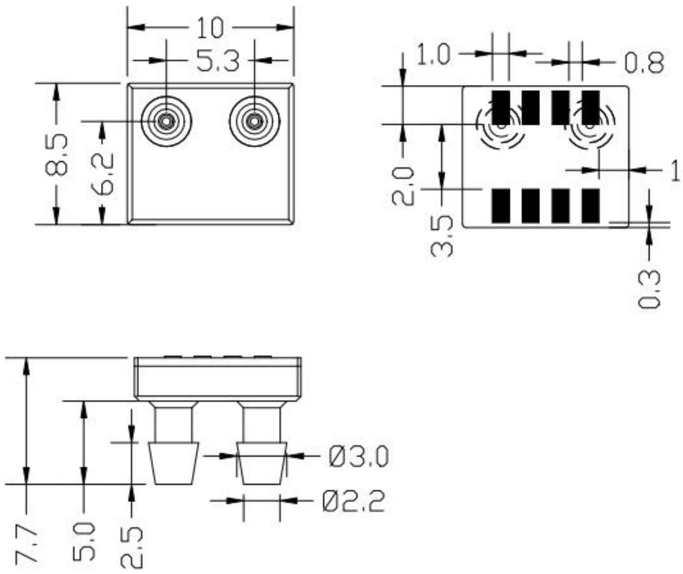


Figure 4. ADP2000 (unit: mm, tolerance: ± 0.1 mm)

Warning and

Do not apply this product to a safety protection device or emergency stop equipment, and to any other application that may cause personal injury due to the failure of the product, unless for a specific purpose or authorization for use. Refer to the product data sheet and instructions before installing, processing, using, or maintaining the product. Failure to comply with the recommendations may result in death or serious personal injury. The Company will not bear all compensation for personal injury and death arising therefrom, and will also exempt it from any possible claims against its managers and employees and affiliated agents, distributors, and others, including various costs, claim fees, attorney fees, etc.

Quality assurance

Guangzhou Ausong Electronics Co., Ltd. shall provide the quality assurance of its products in the following table (calculated from the date of delivering the goods), with the technical specifications indicated in the Ausong Electronics product specification. If the product is proven defective during the warranty period, the company will provide free repair or replacement services.

Warranty description

Category of the product	Defects liability period
The ADP2000 differential pressure sensor	12 Months

The Company is only responsible for the defective products where the application meets the technical conditions of the product. The Company does not guarantee that the product is applied in non-recommended special scenarios. The Company also makes no commitment to the reliability of the products applied to other non-company supporting products or circuits.

This manual is subject to change without prior notice.